UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/603,976	06/25/2003	Jong Goo Jung	30205/39380	3741

4743 7590 07/20/2004

MARSHALL, GERSTEIN & BORUN LLP
6300 SEARS TOWER
233 S. WACKER DRIVE
CHICAGO, IL 60606

EXAMINER	
SMOOT, STEPHEN W	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 07/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/603,976	JUNG ET AL.	
	Examiner	Art Unit	
	Stephen W. Smoot	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 June 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6-25-03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office action is in response to application papers filed on 25 June 2003.

Specification

1. The disclosure is objected to because of the following informalities:

On page 6, line 7, change "2" to --112-- because the word line is designated by reference number 112 in Fig. 2; and

On page 6, line 30, change "polishing" to --etching-- because an etching process is being described.

Appropriate correction is required.

Claim Objections

2. Claim 15 is objected to because of the following informality:

In claim 15, line 13, delete "in" to correct grammar.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 15-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 15 recites the limitation "the overlap portion" in lines 4-5; and

Claims 16-22 depend on claim 15.

There is insufficient antecedent basis for this limitation in claims 15-22.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 3, 7-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Yu et al. (US 5,225,034).

Referring to column 2, line 33 to column 4, line 13, Yu et al. disclose an aqueous chemical mechanical polishing slurry that can include HOCl added in a most preferred amount that ranges from 3 to 8 % (see column 3, lines 32-35). Alumina (i.e. Al_2O_3) can be added to the slurry as an abrasive (see column 3, lines 35-37). The slurry can be used to polish copper and barrier layers back to a silicon dioxide insulator (see column 3, lines 42-53). These are all of the limitations set forth in claims 1, 3, 7-10 of the applicant's invention. Regarding claims 11-14, the claimed selectivity ratios are properties that would be inherent to the slurry of Yu et al. because Yu et al. have the same compositions as claimed in claims 1, 7, 10 and, accordingly, these compositions must have the same properties (see MPEP section 2112.01).

7. Claims 1, 3, 5-6 are rejected under 35 U.S.C. 102(b) as being anticipated by Kido (US 5,800,577).

Referring to column 12, line 66 to column 13, line 8, Kido discloses a comparative example of a water-based polishing composition that uses aluminum oxide as an abrasive and nitric acid (i.e. HNO_3 – in this case X is nitrogen and n equals 3) as an additive to adjust the pH to 3.2. The ability of the composition to polish a thermally oxidized silicon substrate is evaluated (also see column 8, lines 44-48). These are all of the limitations set forth in claims 1, 3, 5-6 of the applicant's invention.

8. Claims 1-4, 11-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Miyashita et al. (US 5,861,054).

Referring to Fig. 4 and column 5, line 60 to column 7, line 36, Miyashita et al. disclose polishing compositions that use either fumed silica, alumina, or ceria as abrasives for polishing silicon dioxide (see column 7, lines 2-4). Nitric acid (i.e. HNO_3 – in this case X is nitrogen and n equals 3) is used as the solvent (see column 5, line 65 to column 6, line 1). The preferred particle size of the abrasive is 10 nm to 40 nm (see column 6, lines 11-14). For the case of using alumina as an abrasive, polishing selectivity of oxide to nitride is 1:1 (see Fig. 4). These are all of the limitations set forth in claims 1-4, 11-12 of the applicant's invention.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 15-16, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Juengling et al. (US 6,060,783) in view of Miyashita et al. (US 5,861,054).

Referring to Figs. 2-6 and column 1, line 59 to column 3, line 20, Juengling et al. disclose a prior art method for gate/wordline stacks that include the following features:

- The stacks include polysilicon lines (24a, 24b, 24c) and nitride caps (27a, 27b, 27c);

- The stacks have nitride sidewall spacers (28) and are covered with an interlayer of BPSG (30);
- Contact openings to silicon substrate (10) are formed in the BPSG layer (30) as shown in Fig. 4; and
- The contact openings are filled with doped polysilicon (44, 46, 48) and can be polished back by CMP until the nitride cap (31) is exposed as shown in Fig. 6.

These are limitations set forth in claims 15-16, 19 of the applicant's invention.

However, Juengling et al. lack the limitations set forth in claim 1 of the applicant's invention, which are directed to a CMP slurry composition and are also limitations of claim 15.

Miyashita et al. disclose polishing compositions for polishing silicon dioxide that include abrasives added to a nitric acid solvent (i.e. HNO_3 – in this case X is nitrogen and n equals 3) (see column 5, line 65 to column 6, line 1 and column 7, lines 2-4). They further disclose CMP slurries that that have about the same polishing selectivity for polysilcon and silicon dioxide (see column 2, lines 45-65).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Juengling et al. and Miyashita et al. in order to polish back the polysilicon and BPSG layers of Juengling et al. using the nitric acid based polishing slurries of Miyashita et al. Miyashita et al. recognize that some CMP slurries have polishing selectivities for polysilicon and silicon dioxide that are about the same (see column 2, lines 45-65) and, they could therefore be used for polishing both types of layers in a single slurry process.

11. Claims 17, 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Juengling et al. (US 6,060,783) and Miyashita et al. (US 5,861,054) as applied to claim 15 above, and further in view of Lin et al. (US 5,877,052).

As shown above, the combination of Juengling et al. and Miyashita et al. has all of the limitations set forth in claim 15 of the applicant's invention. However this combination lacks the further limitation to claim 15 set forth in claim 17 of the applicant's invention, which is to pattern the word line by etching using carbon tetrachloride or chlorine gas. Also, this combination lacks the further limitation to claim 15 set forth in claim 21 of the applicant's invention, which is to use silane or disilane as the polysilicon source gas. Lin et al. teach that chlorine gas can be used for patterning a polysilicon gate (see column 4, lines 7-13). They also teach that silane or disilane can be used for depositing polysilicon by CVD (see column 3, lines 53-62).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Juengling et al., Miyashita et al., and Lin et al. in order to deposit a polysilicon layer using silane or disilane as the source gas and using chlorine gas as an etchant to pattern this polysilicon layer into a gate structure as taught by Lin et al. Lin et al. recognize that silane or disilane can be used as the silicon source gas for depositing polysilicon by LPCVD (see column 3, lines 53-62) and that chlorine gas can subsequently be used to etch the polysilicon into a gate structure by a conventional RIE process (see column 4, lines 7-13).

12. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Juengling et al. (US 6,060,783) and Miyashita et al. (US 5,861,054) as applied to claim 15 above, and further in view of Clampitt (US 5,994,232).

As shown above, the combination of Juengling et al. and Miyashita et al. has all of the limitations set forth in claim 15 of the applicant's invention. However this combination lacks the further limitation to claim 15 set forth in claim 18 of the applicant's invention, which is to use TEOS or silane as a source material for forming oxide spacers. Clampitt teaches that wordline spacers can be formed using TEOS (see column 4, lines 47-64).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Juengling et al., Miyashita et al., and Clampitt in order to form the spacers using TEOS as taught by Clampitt. Clampitt recognizes that TEOS-based spacers are known in the art (see column 4, lines 61-64).

13. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Juengling et al. (US 6,060,783) and Miyashita et al. (US 5,861,054) as applied to claim 15 above, and further in view of Jeng et al. (US 6,033,962).

As shown above, the combination of Juengling et al. and Miyashita et al. has all of the limitations set forth in claim 15 of the applicant's invention. However this combination lacks the further limitation to claim 15 set forth in claim 20 of the applicant's invention, which is to form the contact hole using C_4F_8, C_2F_6, or C_3F_8 as an etching gas.

Jeng et al. teach the formation of contact openings in BPSG using an etchant that includes C_4F_8. (see column 4, lines 38-58).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Juengling et al., Miyashita et al., and Jeng et al. in order to etch BPSG using C_4F_8 as taught by Jeng et al. Jeng et al. recognize that their etchant chemistry is highly selective to BPSG with respect to silicon nitride, which allows for overetching to completely remove BPSG from the contact opening (see column 4, lines 43-48).

14. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Juengling et al. (US 6,060,783) and Miyashita et al. (US 5,861,054) as applied to claim 15 above, and further in view of Curry, II (US 5,142,828).

As shown above, the combination of Juengling et al. and Miyashita et al. has all of the limitations set forth in claim 15 of the applicant's invention. However this combination lacks the further limitation to claim 15 set forth in claim 22 of the applicant's invention, which is to use a hard pad for the CMP step. Curry, II teaches that hard pads may be used for CMP (see column 3, lines 36-66).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Juengling et al., Miyashita et al., and Curry, II in order use a hard pad as taught by Curry, II for CMP polishing. Curry, II recognizes that hard pads offer the advantages of faster polishing and a more planar finish (see column 3, lines 46-50).

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Sun et al. teach polishing slurry compositions.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-272-1698. The examiner can normally be reached on M-F (8:00am to 4:30pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

sws

Stephen W. Smoot
Patent Examiner
Art Unit 2813